# TASK FORCE ACTIVITY

## GATES ENERGY PRODUCTS

## GAINESVILLE,FLA.

## 10/3-10/4/89

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Premise: NASA Standard Nicad Cells made by Gates are not as "Good" as those made by G.E. in '68-'78, Particularly in LEO.

Approach: Compare 50 AHr NASA Standard and USAF "Lightweight" Designs with "Old" 20 AHr NASA Standard Design. Review Gates Manfacturing Facility, Process, Gates IR&D, and JPL Data from COBE Test.

$Li/FeS_2$- 1.75V, 2474 $WHr/dm^3$, 40.6 $WHr/in^3$
Lo Voltage, moderate on weight basis. Available Cells are Shock-Sensitive.

"Rule-of-Thumb": Practical Cells which yield 30% of the above theoretical (Net Electrode) Values are an efficient Design.

"Bottom Line": Li/CFx is the best Near-Term Lithium Primary System for Moderate to Low Rate Use. Further Work can Improve it further.

Practical Lithium Anode Cell Performance

Ragone Plot Energy Density vs Power Density

$Li/CFx$, $Li/SOCL_2$, $Li/SO_2$

Li/CFx from 3/88 Rev. "DD" Prototype Matrix @ 25°C., $Li/SOCl_2$ & $Li/SO_2$ from Gabano*

Altus $Li/SOCl_2$ Specifications

Eagle-Picher LCF-112 Specifications

Eagle-Picher LCF-111 Preliminary Specifications

E-P Proprietary (IR&D) Development
Depression in end of Discharge Curve
Indicates Mass Transport Problem
Highest Specific Energy Cell so Far
Development not Complete

SAFT LO-26SX Specifications ("D")

LO-50 "DD" not used because of Thermal Problems (Scaleup from "D" to "DD" not simple with $Li/SO_2$)

3/88 Rev. Li/CFx "DD" Performance Data

Low Rate Cell Optimization
Much Higher Specific Energy & Energy Density than Matsushita or other U.S. Technology

Li/CFx Cell Design:

Li Couple Specific Energy (based on Gabano)*

Li/$F_2$- 6.05V., 6254 WHr/Kg, 2843 WHr/lb.
0 Chance of Ambient Temp. Cell in 10 yr.

Li/$Cl_2$- 3.98V., 2516 WHr/Kg, 1144 WHr/lb.
little Chance of Ambient Temp.Cell in 10 yr.

Li/S- should be Li/$S_8$ which moves down scale
to 432 WHr/Kg, 196 WHr/lb.

Li/CFx- 2.82V, 1992 WHr/Kg., 909 WHr/lb. (Gabano)
2.83V, 2112 WHr/Kg., 960 WHr/lb ($CF_{0.95}$,Author)
Best near-term Specific Energy System

Li/$CuF_2$- 3.54V., 1644 WHr/Kg., 747 WHr/lb.
Shock-Sensitive, Anhydrous- Positive Electrode
Passivates, + $H_2O$- High Self-Discharge

Li/$SOCl_2$- 3.66V., 1477 WHr/Kg., 671 WHr/lb.
Shock-Sensitive, Safety Problems not all under-
stood, Voltage Delay, Low Efficiency at low rates, good
Moderate to High Rate System

Li/$SO_2$- 2.91V., 1098 WHr/Kg., 499 WHr/lb.
Best High Rate System at Low Temperatures, Vents at
Temperatures above about 85°C.